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ABSTRACT

The prime objective of this review was to examine the existing literature relating to proposal development and evaluation in order to establish a perspective on any empirical base underlying the process. Findings related to seven areas are presented: preparing the proposal, utilization of support services, preparation cost and return relationships, reviewing and evaluating proposals, establishing credibility of the peer review process, proposal quality and program success, and perceptions and attitudes. Observations on both substance and methodology are synthesized, and include: (1) very few empirical studies have been directed toward the task of actual proposal preparation; (2) support services provided to proposal developers found to be most useful focus upon the somewhat mechanical aspects of a proposal; (3) training in proposal development is a justifiable service and cost; (4) the return on investment justifies the costs of development; (5) the decision points in the development process within an institution should be the object of careful study; and (6) the predominant method for research on proposal development tended to be some form of correlational analysis. (BW)

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# College of Education

## PROPOSAL DEVELOPMENT AND EVALUATION:
## A SYNTHESIS OF EMPIRICAL STUDIES

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FINAL REPORT

# PROPOSAL DEVELOPMENT AND EVALUATION:

## A SYNTHESIS OF EMPIRICAL STUDIES

Dr. Desmond L. Cook
Professor of Education and Psychology
Department of Educational Theory and Practice
College of Education
The Ohio State University
Columbus, Ohio 43210

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# PROPOSAL DEVELOPMENT AND EVALUATION:
# A SYNTHESIS OF EMPIRICAL STUDIES

## I. INTRODUCTION

### Purpose

The past several decades have witnessed both inside and outside the field of education an increase in activity relating to the acquisition of external resources to support internal research, development, and service efforts. The roots of this resource seeking activity lie in the adoption by many federal and other funding agencies of the "project" concept. To secure external funding, the dimensions of a proposed project have to be outlined in a document referred to as a "proposal." As the amount of funds available has increased over time so has the activity of developing proposals to secure access to these funds. Thus, a pattern of professional activity has developed on both an individual and institutional basis devoted to the task of writing proposals.

Given that this process of proposal creation has become very extensive, it would seem logical that the task of proposal development should be based upon principles and practices derived in so far as possible from empirical studies. What principles do exist appear to be based upon a "show and tell" or "folklore" approach wherein an individual's views are expressed on the best procedure to make sure one "gets funded." Such self-reports may be of value especially if one were able to accumulate the individual experiences into some form of collective wisdom. Even if that were brought about, the establishment of principles and practices based upon valid and reliable empirical evidence would seem to provide a more desirable base of knowledge.

The purpose of this study was an initial attempt to determine the nature of empirical studies relating to proposal development existing in published and retrieval form. As such, the study was considered as an exploratory "state-of-the-knowledge" investigation. The results of such a study would be helpful not only in establishing a knowledge base but would also provide some perspective on what issues or problems have been studied, how they have been approached, and what studies might be initiated in the future. This report presents the results of that exploratory investigation.

The general literature relating to proposal development is quite extensive and covers many substantive and discipline areas from human services to military procurement. Within that literature base, the focus here was to be upon two major aspects of it. First, a focus on what were chosen to be called "empirical studies." Such studies were those wherein an investigation was undertaken to answer a question of interest or to test a hypothesis, where data were collected and analyzed, and conclusions drawn. Such studies could take the form of self-report surveys, interviews, ex post facto analysis, or experimental investigations. Literature reporting on personal observations alone were not to be included. Selected reports from several federal agencies reporting on proposal evaluation were included because the information presented was deemed to be of sufficient interest to those developing proposals. Second, there was to be a major focus upon the field of education in view of the major utilization to be made of the results. Studies and reports from areas outside of education were included if they fell within the general definition of an empirical study, the content was correlative with the processes involved, and were consistent with the purpose of the study.

## Data Collection

The basic process of data collection consisted of identifying studies and reports, securing original documents where possible, reviewing their contents for suitability, preparing notes and abstracts, assembling them into similar or related topics, and then fitting them into a framework for presentation and synthesis.

The process of study identification was done principally thru the use of information storage and retrieval systems and searching data bases that would most likely include reports dealing with proposal development. A profile of basic and related terms (see Appendix A) was developed with the assistance of the Mechanized Information

Center of The Ohio State University. Using this profile, the data bases searched were Dissertation Abstracts, Educational Resources Information Center (ERIC), Management Abstracts, National Technical Information Service (NTIS), Psychological Abstracts, and Sociological Abstracts. No time frame limited the search of the data bases. In addition to searching mechanized data bases, letters were sent to selected personnel located principally in the field of education requesting them to forward the titles of any studies with which they were familiar.

The process of study identification had a form of "ripple effect." One reference would make note of a related study. In such cases, efforts were initiated to secure a copy of the related document. Whenever possible primary sources were reviewed instead of relying on abstracts or secondary documents.

Each document identified and secured was examined first to determine its relevancy to the study. If accepted, it was screened for empirical data organization and analysis. Suitable studies were then categorized as to the process step in proposal development and evaluation to which it mainly referred. Bibliographical information was developed along with abstracts and notes to be used in generating the basic report. All summaries and notes used in the analysis were prepared solely by the author.

The data collection period approximated the time from September 1982 to August 1983. Even with the use of agencies such as interlibrary loan and related services, delays were encountered in securing some documents and some identified reports were just not available thru normal change channels. Personal letters addressed to the authors were often returned as not deliverable.

## Organizing Structure

As noted above, each study was placed in a structure reflecting the general process steps in proposal development and evaluation. Proposal development was the general category for studies and reports relating primarily to the task of creating a proposal within an institutional setting. Proposal evaluation was the category involving studies and reports relating to the review, evaluation, and funding of proposals after submission to a support or funding agency. Subtopics within each of these two principal areas were developed to highlight the particular emphasis of one or more studies. A section on attitudes and beliefs about the process as a totality or in part was included as a result of identifying studies seeking such information. After the major task of categorizing and summarizing the reports was completed, a synthesis of major findings was established to reflect the "state-of-the-knowledge". The synthesis was used to support a series of conclusions and implications regarding the process of proposal development and evaluation.

## II. PREPARING THE PROPOSAL

The prime task or work effort focuses upon development of the actual proposal. There are any number of books, brochures, pamphlets, and guidelines derived from past experience, both individually and collectively, to provide the prospective proposal developer with assistance. The available literature is rather voluminous and cannot be reviewed here. In searching this same literature for studies and reports relating to actual proposal preparation, the process appears not to have been highly investigated. Six studies were identified that could be considered as being related to the actual tasks of proposal preparation. Three of the studies, however, are probably best classified as case study reports describing the relationship between proposal development and other institutional considerations.

### Initiating Proposal Development

In the typical case, proposals are created as a response to either some form of general program announcement or to a Request for Proposal (RFP) issued by a funding agency. The RFP case often restricts the proposal writer in terms of the dimension of how a response should be addressed. Further, the response would be controlled to some by degree by the need to understand what the RFP is requesting.

The ability to comprehend an RFP was investigated by Milbrandt (1979) in a study concerned with the language used in Department of Defense Contracts to determine if such usage hindered communications and understanding. The study focused upon determining the readability levels of various documents, including RFPs. Using different readability fomulas plus personal interviews, the findings showed that the RFP had a readability level at the college level by one formula, a Dunning Fog Index of 17.7, and a grade level of 11.7 for the AF formula. Based upon these results plus the comments secured from the interviews, particularly of small vendors, the author suggested that readability was not a problem for the potential vendors. The interviews indicated that if there was a problem, resolution was secured through the use of professional, technical, and legal staff personnel. The author did note that in some cases small vendors might not become involved in seeking contracts due to the volume of documentation to be understood. The study is limited in its reporting since no data is presented as to the number of documents of each type reviewed or how many actual interviews were conducted.

As noted, the response to an RFP is controlled by the funding agency as to information to be supplied by a prospective vendor. Dycus (1976) investigated the impact upon proposal evaluation if a developer should present a counter argument to the contents of an RFP. Conceptually, Dycus operated from the research of Hovland and others with regard to the effects of one-sided (supportive defensive only communication) against a two-sided (combined supportive and refutation defensive communication). The latter approach is considered as being superior. The study involved the construction of two mock proposals in response to a short statement of work from the Federal government. For each proposal, the management plans only were modified. One proposal presented only information in response to the RFP while the second presented not only the required information but presented a counter argument with regard to the location where the program tests should be conducted. The government's option was refuted and the company's main facility was advocated. In both proposals, paragraph and work length were equal.

Using mail procedures, the proposals were rated by 27 experienced proposal evaluators based on a set of nine evaluation criteria using a scale of -3 to +3. One criterion was presumed to reflect the response contained in the management plans. Order effects were controlled. The results showed that the two-sided communication rated higher with a mean of 1.5 versus 1.2 but the difference was not statistically significant. Dycus concluded that the sideness of a communication did not strongly dominate over the substance of the message.

In the article, Dycus references a second study he conducted which appeared under the title "The Relative Effectiveness of Two Proposal Approaches - An Experimental Study" which appeared in Technical Communications in 1975. Letters addressed to the author were returned and attempts to locate the study through information retrieval systems have not yielded the report. It is not possible, therefore, to know if the same study above was being reported upon or if a different experiment had been conducted.

As part of a project to review and evaluate the Small Project Grants Program of the Bureau of Research of the Office of Education (DHEW), Rogers, Sanders, and Levenson (1969) sought information from applicants as to how they heard about the program. Since the study is referenced in subsequent sections of this report, selected details about the study are presented now.

Briefly, the Small Grants Program operated out of the nine Regional Offices of Education with the general purpose of stimulating educational research, particularly in small colleges and among young researchers. Grants were limited to $10,000. Information was sought in 1969 from funded and non-funded applicants of the program for fiscal year 1968. For the period involved, there were 874 applications with 298 funded and 585 not funded. Usable completed questionnaires were returned from 665 applicants for a return rate of 78 percent. In March 1970, questionnaires were sent to the 512 field readers who reviewed the proposals with 423 responses returned. Details regarding follow-up procedures are presented in the report text. Of the total report, three sections are of principal interest to the current investigation; namely, the proposal contents, its development, and its processing after submission. Since the section on proposal content details an analysis of such topics as research design, sample size, use of computers, statistical analysis procedures, and budgets and not per se on its development, findings relevant to those issues are not presented in this report. Findings with regard to proposal development and evaluation are presented in this report as the results seem relevant to the major section involved.

Rogers and others solicited responses from applicants as to how they heard about the Regional Research Program (RRP), at what point their research plans were formulated, and the nature and number of the resources used in preparing the proposal. Information about the program was most often secured from a colleague or superior (64 percent) followed by personal contact with USOE official (12 percent), oral presentation by USOE official or USOE written materials (10 percent), and other sources with lesser percentages. In terms of resources available for preparing the proposal, 87 percent indicated access to the Small Grant guidelines, 72 percent to a resource person knowledgeable about applying for grants, with 45 to 33 percent having available resources such as copies of previously submitted proposals, sample application forms, information banks of agencies funding research, and ERIC materials. Only 10 percent indicated they had access to an USOE paper written on how to win a grant. Data presented with regard to the number of sources used in developing the proposal indicated the proportion of applicants funded tended to increase as more resources were available running from 36 percent for one source up to 45 and 46 percent for four or five sources. In contrast, other data revealed that having a resource available was more highly related to funding than actually using it in preparing the proposal. When asked if they had talked with an USOE official, only two out of five did so. Of those who did, a larger proportion (43 percent) were funded. Of the group who talked with the agency official, 96 percent of those funded indicated that it was helpful while only 64 percent of those not funded said it was helpful. The person most often met with was the Director of Research (68 percent) at the several regional offices. When asked if the proposal was written on their own time or on working time, 347 or 52 percent indicated they wrote on their own time. Of the group that wrote on their own time, about 1 out of 3 (36 percent) were funded. Information was sought from applicants as to the juxtaposition of their research plans to the research program announcement. Of the applicants eventually funded, 40 percent indicated that they had a well defined plan before thinking of applying; 30 percent only had a general idea, and 24 percent developed plans after giving thought to applying. Of the total group of 665 applicants, 544 or 82 percent had well developed plans. Even though well developed plans existed, 83 percent had not submitted the proposal to another agency prior to submission to the RRP.

## Preparation and Institutional Relationships

Two studies were identified that related to proposal preparation but in which the focus was upon using the task as a means of accomplishing other ends, particularly institutional change. Cook (1971) and Anderson (1974) describe the process of proposal development as a vehicle for bringing about change in local school district curriculum improvement. Since both studies are similar in nature and focus, the Cook study will be highlighted. The decision to seek funds under the Elementary and Secondary Education Act, Title III, to meet stated educational needs caused a local school district from Superintendent on down to become involved in developing a proposal. In his report, Cook stressed the conflict between the Superintendent and his traditional administrative instrumentalities and the changes created by the preparation of the proposal. He noted that the proposal brought this condition out into the open and would have created morale problems had the superintendency not understood the consequence of not realizing the time and effort that had gone into the proposal development. In her report, Anderson noted that the success of the proposal development effort was judged by the approvals secured from the several offices involved in the development of the proposal, a copy of which is included in the Anderson report.

Both of these studies are case studies of where proposal development rather than being a one-person effort is an institutional effort impacting on various organizational entities and their role and functions. Both reports outlined the general steps followed but such actions were viewed by both authors as being secondary to the function that the proposal development activity played in modifying the organizational structure.

In addition to the studies described above, a third study related to the preparation process in institutional settings should perhaps be included in this section. As part of the Research Management Improvement Program of the National Science Foundation, Jebens, Millstein, and Wearly (1975) and Jebens (1976) report on a study of the decision points and responsibility areas associated with the institutional internal review of proposals developed and submitted using both UCLA and the University of California-San Diego as data sources. Narrative descriptions of the process of generation and review of proposals along with flow chart diagrams of the decision process are included. Most comments are of a narrative nature but some empirical data is presented with regard to the budgetary dimensions of proposals. Based upon an analysis of 100 percent of contracts with all federal agencies and a 33 to 50 percent sample of NIH and NSF grants for 1974, median changes between requested and awarded funds for 60 contracts from seven different agencies centered around 21 percent; that is, about half of the contracts had changes greater than 21 percent and half had less. Approximately one out of six contracts from seven agencies showed changes in one or more budget categories. As for grants, 146 grants from the seven agencies showed changes of about 24 percent in total budget and about 40 percent changing one or more budget categories. No information was presented in the report with regard to any changes upward or downward only that the categories and total did change. Similar data are presented for change between award allocation categories and actual expenditures. It was noted that there were significant changes for a large percentage of the cases and such changes were to a fair degree large in comparing requested to allocated funds. The report contains comments relative to a variety of topics relative to proposal preparation and its relation to areas such as teaching and instruction, research and university mission, need for proposal training, the assignment of institutional responsibilities for proposal review and clearances including the function of the principal investigator. This report is recommended reading for persons interested in gaining insight into the processes and issues associated with proposal preparation within a large university complex.

## Commentary

Considering the large amount of time and resources devoted to proposal preparation within organizations, it was interesting to observe the lack of studies directed toward such issues as to how the task should be approached, formal and informal procedures for responding, or the value of staff development training sessions. The studies reviewed suggest that individuals can comprehend requests for proposals, initiate responses to them, and often have plans developed in some form prior even to an RFP or program announcement release. The impact upon changes in institutional behavior, including the internal review decisions and organizational commitments, were observed to be present. There appears, however, a lack of studies which can offer suggestions as to how an individual and organization can best proceed with the proposal preparation process.

## III. UTILIZATION OF SUPPORT SERVICES

As a means of facilitating the process of proposal development and submission, it is a common practice for most organizations to establish some structure of support services. These service offices vary in size from a part-time assistant to extensive offices consisting of a number of full-time, specialized staff members representing various disciplines and services. Both types of offices not only assist in seeking grants and contracts but often carry out monitoring operations after funding. Three studies were located which focused upon the use of and value of such support services. One study isolated the costs of providing a specific kind of service.

### Frequency and Value of Services Used

Harty (1977) reported on faculty preferences for support services at a large midwestern university. A 33 item Likert-type scale was constructed listing 6 major service areas and 27 specific service activities. Each service was to be rated from Unimportant to Most Important. The scale was distributed to a random sample of 70 from a total of 228 faculty members. A total of 65 forms were returned with 59 being usable for analysis. Demographic data regarding the level of proposal writing activity and funding, frequency of assistance sought, time at the institution, academic rank, major responsibility, cognate area, and tenure or non-tenure status was secured. Analysis was made for each level of response within each demographic characteristic with mean ratings serving as indicators for identifying level of importance. The Most Important general service activities over the several demographic characteristics were those of Proposal Budgeting, Faculty Interactions, and Funding Information in that order. The Least Important general service activities were Proposal Development, Proposal Routing, and other services. Specific activity items rated as Most Important were such items as Distribution of Seed Money, Funding Information for Specific Projects, and Information on Institutional Costs. Items rated as being of lesser importance related to Information about Postal Deliveries, Access to Style Manuals, and Sample Letters of Fund Solicitation. In summarizing the results, Harty noted that faculty are not too concerned with the mechanical aspects of proposal development, that the faculty more experienced in proposal writing have developed time saving procedures, and that the greatest disagreement regarding importance of services was related to academic ranks and cognate areas.

A similar investigation involving both preparation services and post-funding support was conducted by Fiedler (1979) at a large western university. Using an open-ended questionnaire approach, a randomly selected set of 192 faculty members involved with scholarly research was interviewed. Most of the respondents were from the science fields, were full professors, and 86 percent had applied or were applying or planning to apply for external funding. The respondents were given a list of services and asked to rate their use and the quality of service provided. Responses were coded and mean ratings determined for 10 services with 1 being high and 5 low. In addition to the use and quality of each service, respondents were also asked to indicate the source from which they usually sought such services. The number indicating each of the services varied so both frequencies and percents were reported.

The most frequently mentioned services used were Clerical/Secretarial Assistance and Duplicating Services with mean ratings of 1.9 for Clerical assistance and 2.0 for Duplicating assistance. Ratings of quality of service were 2.0 for Clerical Assistance and 1.8 for Duplicating Services. The item least frequently mentioned and also rated lowest in importance with a mean rating of 3.6 was that of Editorial Assistance in Presenting Data in

Proposals. At the same time, this service had a mean rating of 1.8 in terms of quality. Items in between these two extremes in order of relative mean ratings were Assistance with Reporting, Budget Monitoring, and Accounting; Accounting Assistance in setting up budgets and costs estimates; Information on Agency Requirements; Information on Sources of Funding; Notification of RFP's; Information on Available University facilities; and Notification of Current status of proposals and their progress through the grant process. The services rated highest in quality provided in order were Assistance in Setting up Budgets, Duplicating Services, and Editorial Assistance in Data Presentation being rated equally high with mean ratings of 1.8. Other services rated in terms of being lower in quality were Clerical Assistance in Writing Proposals, Information Agency Requirements; Information on Available University facilities and resources; Information on Sources of Funding; Notification of RFP's; and Assistance with Reporting, Budgeting, Monitoring, and accounting; with the lowest rated item in quality being Notification of current status of proposals and their progress. Although the responses varied with the type of service, the faculty member's own department was the most frequently indicated source of support. When asked about which units could provide services, the highest rated was the library and computer centers followed by duplicating, printing, and publications. Additional data is presented by the author with regard to perceptions about rewards for seeking of funds, issues relating to knowledge about the institutional proposal procedures, and items relating to the general areas of research administration and management.

In her discussion of the results, Fiedler noted that the respondents believed the university should provide a variety of services, including training in proposal writing. While there are numerous articles suggesting the nature of such training, only one report was found reporting empirical data on training. Rainey (1974) conducted a study to determine the value of proposal development training. A survey form asking about the importance and nature of proposal development was sent to a random selection of 50 manufacturing firms doing a minimum of $1,000,000 in sales. The corporate executives were asked to indicate the importance of the ability to write both intra- and inter-company business proposals. A second survey was sent to college teachers of business communications who were members of a professional association. They were asked if students were given any time on proposal writing in the course and how beneficial such training would be.

Of the business respondents, 50 percent indicated that proposal writing was of Great or Crucial Importance while 65 percent indicated that proposals play an important part in the operations of the firm. Replies were received from 116 university professors. Thirty-eight instructors (33 percent) thought proposal writing was important enough to have a separate course on the topic. However, only 44 percent thought such a course would be moderately or very beneficial. Some time was given to proposal writing only in courses conducted by 21 teachers.

Using the information from the surveys plus a review of the literature on proposal writing along with information from informal conversations with both businessmen and students, Rainey offers ten untested hypotheses about proposal writing and its role in undergraduate business training along with behavioral objectives for a proposal unit and a list of student activities.

## Cost of Information Services

To facilitate the seeking of sources of funds, most institutions arrange to have some support service in the form of a "library" or information system identifying agencies which accept proposals. Hensley and Williams (1981) examined the utility of such a library by relating its use to costs, a point not previously noted in prior studies dealing only with use. They developed a means of recording costs associated with the three main functions of the system; Developmental or the providing and disseminating of information about funding opportunities; Administrative or the obtaining and dissemination of information about project management; and Acquisition or soliciting and storing of information related to research development and administration. Costs were obtained and assigned to the three respective functions. For the fiscal year 1980, the total direct library costs were $38,683 with about one-third of the costs going to professional salaries. If an indirect cost rate of 53 percent is added, the total costs were $59,224. In terms of function, about 71 percent of direct costs was spent on Development, about 11 percent for Administration, and about 18 percent for Acquisisiton function. The authors also attempted to isolate the costs associated with targeting information to selected faculty members. They distinguished between general information costs and direct targeted costs. Using data from the costs of library functions, they noted that the general information costs were about $7,700 a year while targeted costs were about $14,735 per year which results in a per-unit cost of approximately a dollar per bit of information. The authors concluded that the costs of about $10 per year per faculty member for general information distribution and a one dollar cost for targeted information notes were reaonable costs in terms of the resources that could be returned by successful proposal funding.

Commentary

Based upon the studies cited in the preceding paragraphs, it can be noted that there have been attempts made to ascertain both the kind of services provided in support of proposal development, the quality of service, the preferences for services, and some idea of their costs within academic settings. In general, it would appear that these studies support a position that the services deemed important focus upon the creative act of proposal writing and funding with a lesser emphasis on mechanical aspects of the process. In general, such assistance is sought from the immediate support area supplemented by remote offices. Training in proposal writing was deemed to be of some value as was the provision of information services.

The general picture derived from the combined studies indicates that most organizations feel that support services are justified in relation to the potential benefits received from the acquisition of external funds. There were, however, several studies identified which attempted to justify the costs of development in relation to the return on the investment. These studies are reviewed in the next section.

## IV. PREPARATION COST AND RETURN RELATIONSHIPS

The preparation of proposals requires individual time and effort as well as the provision of organizational services to support such efforts. Thus, there are costs associated with the creation and submission of proposals. In view of the resources utilized, a question might be raised as to whether or not there is an adequate return for the investment involved. The purpose of this section is to review papers and reports seeking information on both the costs of preparation as well as examining the return on the investment.

Seven studies were identified that sought information on cost estimates. Three reports did not involve empirical approaches to estimating such costs but rather reflected "guesstimates" based upon an inductive analysis of preparation activities in selected situations. These papers are reviewed here because they were considered forerunners to developing preparation costs estimates and are often referenced by other authors. The remaining four studies sought data relative to preparation costs and often matched them against funds received in order to secure some idea of return on investment.

## "Guesstimates" of Costs

Chiappetta (1973) projected the costs of proposal development at Indiana University in response to a solicitation from the National Institute of Education. Using an estimated average for a professor's salary, time given to writing, clerical assistance provided, and related aspects, a cost of $2,035 for an individual proposal was secured. It was noted that 27 proposals were developed leading to a university investment of $54,035. A similar approach was taken by Buechner (1974) at Kent State University and with cost of proposal development estimated at $1,253 for the same program. He noted that if donated time was taken out of the total, the cost would be reduced by $1144 or an actual total cost of $190 dollars. He then notes that a total of 3,126 proposals were submitted for an aggregate investment of about 4 million dollars to spend 11.3 million which was the final amount awarded. On this basis, the author suggests that a minimum of 340,000 was invested to secure 11.3 million which he views as a good return on investment.

While not attempting to project a dollar figure, Leopold (1979) also estimated the amount of time and person-hours devoted to the preparation of proposals and questions the return on investment. He noted that in 1978 there was an approximate total of 47,500 proposals submitted to five different federal agencies in one year. Using an estimate of three weeks as the average time to write a proposal, he estimated 2,700 man-years went into proposal development which he considered to be a conservative estimate. Adding 3 person-days to review a proposal for a total of 575 man-years, an estimated total of nearly 3,300 man-years was given to proposal development and review. Considering the rejection rate running from 70 to 85 percent, he questions the investment of time while believing that proposal creation will increase due to the competition for funds. The author suggests that the act of writing proposals to do research could serve to bring active research to a halt!

## Empirical Cost-Return Studies

The above reports attempt to estimate the costs of proposal development but without the accumulated data from actual proposal development and relating such costs to the return on investment in terms of dollars received.

Teague and Heathington (1979) examined the costs incurred by an academic unit at a higher education institution and then related this cost to funding secured. Development expenses were collected under six categories (staff time, typing, duplication, related costs, institutional routing, and indirect costs) for 71 proposal applications divided into 66 grants and 5 contracts. There were 65 new applications and 6 continuations developed for submission to different agencies with 46 applications going to federal agencies, 21 to state agencies, and 4 to private foundations. At the time of the study, 28 proposals were approved, 19 disapproved, and 24 were pending.

The range of development costs was from $231 to $9,280 with the average being $1,961. Personnel time was the largest cost ranging from $50 to $6,500 with an average of $1,124 and accounting for about 58 percent of average total cost. Based upon the proposals accepted or rejected, the cost of preparation was $82,202 while the funded proposals received $1,072,542 for a return on investment of over 10 times the cost.

In view of the findings from the above study, Hensley, Gulley, and Eddleman (1980) did a study which recognized that proposal pay-off might not be independent of the institution involved and that the investment would vary from agency to agency. To secure a better idea of costs, their study divided the proposal development process into four phases: Matching Ideas and Funding Sources, Development of the Letter of Inquiry, Development of the Prospectus or

Pre-proposal, and the Development of the Proposal and an Assessment for Project/Program Concurrence. Using a case study methodology, costs associated with the four phases were logged for four different but related proposals being developed for submission to foundations, private business, state, and federal agencies.

Average costs for the first phase were $360 dollars with private business costs highest at $616 and Federal lowest at $145. For the second phase, the average cost was $348 dollars with Federal costs lowest at $214 and state agency costs highest at $645. For the third phase, the average cost was $661 with highest being $1,289 for foundations and the lowest being Federal at $245. For the last phase, the average cost was $3,428 with the Federal costs being lowest at $2,042. The authors note that the costs summarized over the four phases for the Federal project were $2,554 but costs only for the last phase were close to the average reported by Teague and Heathington. Detailed data were presented for the one Federal project. The total amount approved for the project was $125,231 giving about a 2 percent return on the investment. The authors note that the costs for the Federal project were much lower and therefore it was more advantageous for the university to develop proposals for that agency. No reasons were given as to why costs for private business and foundations were much higher on the average. Explanations as to the low cost of Federal projects focused upon the careful definition of requirements and information by the funding agency, availability of priority area deadlines at a sufficient time before the deadline, and the well developed criteria for review which made proposal development an easier task. The other areas were noted to be more subjective and required more personal interaction between the faculty and the agency program officer. Based upon their findings, the authors noted that the average costs were probably higher than previously reported and that there are variances in proposal development costs in terms of the sector from which support is sought.

In contrast to the development costs associated with relatively large scale proposals are those associated with the development of relatively small grant proposals as reported by Rogers, Sanders and Levenson (1970) in their review of the Small-Project Grants Program for the Bureau of Research, Office of Education (DHEW).

They report that the median time devoted to proposal preparation was about 48 hours. They also note that there was some relationship to funding since for those who devoted less than 20 hours time only 33 percent were funded while for those who spent between 41-60 hours there was a 41 percent funding rate. When asked to estimate costs, the median was $48 with a range from $25 to $100. For over 70 percent of the applicants, this cost was picked up by the institution while 20 percent personally paid the cost. Their data also indicated that the applicants paying their own costs also had the lowest funding proportion.

## A Non-Academic Example

The six reports noted above attempt to estimate or determine actual costs associated with proposal development in academic settings. One report (1971) was identified that attempted to summarize costs in connection with the development of proposals associated with aerospace corporations bidding on the procurement of a weapons systems, in this case the B-1 bomber. The study was undertaken to establish a data base regarding proposal preparation costs, to determine factors associated with the costs, and to reduce costs. In May 1969, a Department of Defense decision was made to move ahead on the development of a prototype aircraft with the RFP being released in November. The plan called for the award of a systems integration contract to one of three airframe competitors, the engine development award to one of two engine companies, and an award to one of two avionics subcontractors of the airframe contractor. The original draft document for the airframe RFP called for 40 volumes but was reduced to 26. The final RFP page-limited three volumes and imposed a 2,300 limit on total pages for 13 of the other volumes. The Technical Proposal was to be submitted in 60 days, Management and Cost Plan in 98 days, and Trade Studies volume in 105 days.

For cost collection, the proposal preparation period was from November 1969 to February 1970 and the Proposal

Evaluation/Source Selection period from February to June. For the three airframe and two engine companies, proposal preparation costs were $19,000,000 with 915 man-years of preparation with $9.5 million considered as not recoverable. For the evaluation period, the total costs were $16,700,000 with 801 man-years and $8,900,000 not recoverable. Total costs were $35,800,000 with 1,716 man-years and $18,400,000 not recoverable. If bid and proposal costs, independent of R and D costs plus other costs from 1964 to 1970 are included, the total is $65,600,000 for the 7 competitors. Combined with proposal development, the total was $101.3 million. The results of this study in weapons systems procurement reinforces the point made in the study by Hensley, Gulley, and Eddleman that proposal development costs vary from institution and agency as well as the item being procured. It seems reasonable therefore that any attempt to project proposal development costs would be dependent upon such variables. Further, the task of collecting costs depends upon how the several phases associated with proposal development are categorized.

Commentary

In reviewing the several reports on cost estimates presented in this section, three main observations seem to emerge. First, that while the evidence is limited, estimates of costs based upon an intuitive approach do bear some similarity to costs based upon empirical data. It may well be that the intuitive approach draws from data based upon experience which becomes more visible when actual data is collected over a set of specific proposals. Second, costs for proposal preparation and thus their relationship to a return on the investment is a consequence of several variables, among them the specificity of an RFP, the agency requirements from which support is sought, and the item being produced. Third, there seems to be a reasonable methodological approach to developing a cost-return ratio which leads to a justification that there is a sufficient positive ratio that organizations can justify the investment of resources to generate and secure proposal funding. In view of the one finding that costs for submission to a Federal agency were lowest, there needs to be an additional study of this finding or else the higher costs of preparation for foundations and private business could serve as a deterrent to submitting program-related items to such agencies for possible support.

## V. REVIEWING AND EVALUATING PROPOSALS

Once a proposal is developed and processed internally within an organization in the manner described by Jebens and others in the preceding section, it is then submitted to the external funding source for its review and funding decision. In the typical case, this review process involves a competition in that many proposals may be submitted to the agency but only a few are finally funded.

The process of choosing among several competing proposals falls under the more general concept of project selection. Like the literature on proposal development, there is voluminous literature, both of an empirical and non-empirical nature, on project selection as it operates in a wide range of settings. The selection methods run the range from the development of mathematical models using "return on investment" (profit increase, market share, etc.) as a dependent variable and various evaluative criteria as predictor variables to other models placing almost complete reliance on subjective personal judgements albeit with some quantitative ratings being involved. Because of the large volume of literature on project selection methods and research, it was not viewed as being possible to include that totality in the current paper. Summaries of these methodologies, such as that prepared by Baker and Pound (1964) are recommended as good sources of information. Instead, the focus here will be upon empirical studies which relate to various dimensions of the review and evaluation process as it operates principally within the natural and social-behavioral sciences in academic settings.

Because of the importance of the process of reviewing and evaluating proposals, there have been quite a few studies relating to this area; perhaps more than to any other topic in the proposal development activity. Many of these studies have focused on identifying reasons for proposal acceptance and rejection, factors determining final decisions, the potential influence of personal factors in peer review situations, and similar topics. An attempt has been made to categorize the studies so as to correspond to various steps in the review and evaluation process. In some cases, only one study is relevant to a section while others are included in several sub-sections.

## Initial Compliance Screening

In the typical case, proposals are initially reviewed at the funding source for general compliance with guidelines and relationship to program or agency objectives. Larsen (1975) conducted an investigation focusing upon the initial screening of grant applications sent to public foundations. The study involved interviews with 21 foundation managers plus a total of 25 hours of observation of board meetings and one session of a grantsmanship training program. In addition, archival items such as annual reports, form letters, and IRS reports were examined. Materials were collected from November 1973 thru April 1974 from foundations located largely in the San Francisco Bay area.

The report noted that each foundation manager developed a personal classification system for reducing the number of submitted applications for subsequent review. Several different criteria were used ranging from a formal item such as presence of a certificate of IRS non-profit status to more informal means. Formal means included meeting of foundation priorities, geographical location, source of financial support, size of request, and organizational affiliation. Larsen noted that informal classification systems were built on such concepts as "worthiness" and dependency". "Worthiness" had subclasses of personal, programmatic, and institutional. "Dependency" focused upon whether or not the agency seeking funds would become dependent upon a continuation of funding. If so, they were not likely to receive initial funding. The author noted that foundation managers attempted to control the behavior of their clientele to some degree using as a basis their own presumed knowledge and experience. An important dimension of this control, which was also related to worthiness and dependency, is that of determining "authenticity" which involves the seeking of information about clients to remove false fronts. For those interested in ascertaining on how foundations screen applications, the article would be informative. From a research methodology perspective, Larsen noted that participant observation was a much more valid method than telephone interviews in studying the activities of foundation managers.

## Formal Review Process

The most commonly used formal means for reviewing and evaluating proposals after the initial screening, particularly scientific research proposals, is the process referred to as "peer review". Over the years, knowledge gained from experience has established that the most preferred way to make necessary judgements about quality of a proposal is to have the proposed effort judged by persons who can be considered as an individual's peers on the position they would be most knowledgeable about such dimensions as significance, purpose, method, and likelihood of results. Much has been written about the history, operation, varieties, and validity of the peer review process (Carter, 1974; Foster, 1976; Vandette, 1977). Some studies relating to these issues will be reviewed later in this report.

Once screened, proposals are typically routed to a peer panel which independently rates them against evaluative criteria culminating in a summative rating and/or score. After the independent rating, the same panel members or a second echelon group may be assembled together to make final recommendations. In these face-to-face sessions, discussion focuses on individual proposals with each rater being given an opportunity to defend, explain, or even to change his or her initial rating. The exchange of information among peer panelists therefore would appear to be an important factor establishing the final ratings.

Peer Information Exchange. One study was identified which attempted to examine the interaction among peer panelists. Paxton (1978) conducted a study, largely exploratory in nature, to determine the amount, type, frequency, substance, and related aspects of the information exchange among peer panel members. Drawing upon the studies of small group processes and direct observation methodology, an initial study was conducted to determine the information dimensions to be recorded and the process for so doing. A revised form was developed to record information/comments relative to the substantive nature of the proposals, comments of a non-proposal but yet of substantive nature, and comments not related to either the proposal or general substance. A four member panel reviewing four ESEA Title III proposals in the state of Ohio was observed during a single rating period. Entries were made for each complete opinion or question made by a panel member. Each comment was given a point credit and then summed for the matrix for each panelist.

The analysis of the individual matrices showed that one panelist consistenty had the most frequent comments. For the four panelists, most of the comments were related to the substantive nature of the proposal. The frequency of comments declined, however, with succeeding proposals being reviewed suggesting a fatigue factor. The frequency of comments did vary according to the final proposal rating but no consistent pattern was observed.

In addition to the observation period, a self-report form sought perceptions from 48 panelists participating in the review process as to how the information exchange influenced their own rating behavior. Each panelist was asked to respond in terms of one proposal, identified by a title, from the set which they reviewed. No two panelists responded to the same proposal. The analysis of the responses indicated that more than half of the panelists did change their initial rating after hearing information presented by other panelists while about one-third did not change. In terms of reasons for changing, the two most frequently given were perceived expertness of a panel member and the quality of the information presented. When questionable proposals had follow-up sessions for further information, only half of the panelists change their rating with this additional information. The panelists not changing their initial rating felt that there was no new information presented in the small group session. The panelists did report a feeling that the session was dominated by a group member but this did not relate to their final ratings.

Paxton concluded that it was feasible to study the information exchange in peer panel meetings; that the quality of information exchanged was of sufficient quality and quantity to provide for reasonable ratings by panelists; that information exchange did influence some changes in ratings; and that most reviewers expressed beliefs that their ratings were not affected by the time of day (sequence of rating) or the dominance by one or two group members.

Agreement Among Panelists. The Paxton study suggested that there was an eventual agreement among the raters regarding the proposal reviewed. The relative nature of such agreement, however, could be high or low. Miner and McDonald (1981) conducted a study to establish the relative agreement among a set of raters by investigating the reliability of ratings on proposals submitted to an internal faculty grants program at Marquette University. The proposals involved summer fellowships which included salary and regular grants which did not.

In 1979, 52 summer grants were submitted with 20 funded while 43 regular proposals were submitted with 24 awarded. Each proposal was rated on a seven point scale using administrative guidelines. Scale values were summed and averaged. The average score counted for 50 percent of total rating with the other 50 percent derived from a pair-rating system using two experts who met and determined a joint rating score. The same procedure was used for both types of grants. Reliability was established using an intra-class correlation coefficient. For summer grants, the reliability was +.68 and for regular grants +.59. The authors concluded that there was little inter-rater reliability. Analysis of the scale items revealed difficulty with mid-range proposals.

Based upon the results, three changes in procedure were made. The committee was changed from 8 to 10 members; a reviewer's checklist adopted; and the weighting changed to 67 percent for a single rating and 33 percent for the paired rating. This new procedure was used in 1980 for 54 summer applications with 19 awards and 34 regular applications with 22 awards. Intra-class correlations for summer grants were +.85 and for regular grants +.79. This same procedure was used again in 1981 with 33 summer applications and 51 awards and with 35 regular applications and 25 awards. The resulting intra-class correlations were +.89 for summer and +.80 for regular grants. The authors concluded that the revised process led to a greater stability or agreement among raters and is now the current procedure.

While the Paxton study and the work of Miner and McDonald involved the agreement among panelists in evaluating proposals, they did not examine the results using different groups of panelists. One study making a comparison of the agreement from two different groups of panelists was that done by Foster (1976). The items reviewed were preliminary grant proposals submitted to the Comprehensive Program of the Fund for the Improvement of Post-Secondary Education in 1975. Two groups of readers, one identified as Field Reader group and the other as Field Advisor group, rated the proposals. The Field Reader group involved 74 individuals from various post-secondary education agencies who had not submitted a proposal to the program plus FIPSE staff. The Field Advisor group consisted of 1,077 volunteer applicant-reviewers who agreed to have their own proposal reviewed by other applicants and who also agreed to review five proposals each. In contrast, the Field Reader group was to review 20 to 25 preliminary proposals on a voluntary or fee basis. All reviewers were provided with forms and also completed a questionnaire seeking profile data and opinions about the field advisor system.

Each preliminary proposal was rated as In, Possibly In, Possibly Out, and Out. Of the group rated as In and Possibly In, the ratings were reviewed by FIPSE staff and a final set of applicants asked to submit detailed proposals. Of the 1,850 preliminary proposals, 180 detailed proposals were requested. The detailed proposals were reviewed by the FIPSE staff and funding decisions made.

Comparisons of rating performance and agreement between the two experimental groups (Field Advisor, Field Reader) and the control group (FIPSE staff) were made by use of mean scores and correlations with the author reporting both "t" values and correlations coefficients. The analysis in terms of the question about the agreement between the two experimental groups (Advisors and Readers) revealed a correlation of .25 for all preliminary proposals, a correlation .07 for proposals In and Possibly In, and correlation of .23 for Possibly Out and Out proposals, and .11 for In proposals. Two of the correlations (.25 and .23) were significant at the .01 level. The highest significant correlation (.01 level) was .54 between the FIPSE Staff and Field Reader reviews for all preliminary proposals, followed by a significant correlation of .41 between these same two groups for Possibly Out and Out proposals, and .38 for the Staff-Reader agreement.

Based upon these correlations and the results of the tests of means, the author concluded by noting that the two different groups gave reviews that are comparable. A notation is made that the two groups, Advisors and Readers, had quite similar profiles and in terms of position and institutional locations thus negating these as factors. In terms of opinions about the field advisor system, 70 percent of the Advisor group thought the procedure was more beneficial than the Field Reader approach while 18 percent thought it was worse. The prime reasons for feeling it was not as beneficial related to possible conflict of interest and unknown competency of the Advisor group.

### Comparisons Between Accepted and Rejected Proposals.

Once funding decisions have been made, interest focuses upon why some proposals were winners and others losers. Were rejections and awards based upon favoritism, politics, panel bias, inadequate review processes, or a host of other possible explanations or rationalizations? Most reference texts dealing with proposal development cite the early study of Allen (1960) on deficiencies of 605 Public Health Services grants, the work of Smith (1964) in citing the weaknesses of proposals rejected by the Cooperative Research Program of the U. S. Office of Education, and/or the study by Chalfant and Nitzman (1965) on limitations of applications to handicapped children research program. These studies have not been reviewed in this report because they are so commonly referenced and the fact that they report only lists of deficiencies or inadequacies and do not involve comparisons between accepted and rejected proposals. The studies cited here involved some form of comparison in one manner or another. Two studies were identified that made comparisons on selected proposal characteristics as they relate to ratings on evaluative criteria or funding decisions. Interestingly both were doctoral dissertations using similar statistical analysis procedures in focusing upon the same issue.

The relationship between the presence or absence of selected proposal characteristics to their total rating was examined by Wilson (1977) for 353 applications out of 361 submitted to the Vocational Education Research Branch of the Office of Education. Proposal attributes intuitively selected based upon empirical definition, mutual exclusivity, independence from the dependent variable, and apparent variability across proposals were used as independent variables. The characteristics included such items as table of contents, abstract, review of literature, tables and charts, identification of project director by name, citation of references as footnotes, and glossary of terms for a total of 22 such characteristics. The dependent variable was the mean score computed for total score ratings summed over evaluators. The mean scores for proposals having or not having the attribute present were tested by a one-way analysis of variance. Multiple regression techniques were also used in order to establish the unique contribution of each attribute.

The analysis of each attribute showed that only the presence or absence of the literature review was not statistically significant. In addition to the application characteristics, the multiple regression included the priority area addressed by the proposal and the type of institution making application. The multiple correlation (R-squared) was +.463. In terms of stepwise procedure, the item making the greatest contribution was the priority area of application followed by the agency making application, and the several proposal characteristics.

In contrast to the Wilson study which looked at a wide range of general proposal characteristics, Howarth (1980) investigated the technical factors or research methodology variables which would serve to discriminate between good and poor proposals. The proposals involved were those submitted and funded in connection with the National Institute of Occupational Health and Safety and drawn from the Cincinnati, Ohio area.

Using research literature, a list of 63 technical aspects of research design and analysis was established. Forty-four project officers for 72 projects currently active in 1979 or within three months of completion were asked in an interview to indicate relevancy (or irrelevancy, optional, or uncomfortable) of each variable for the research project involved. The frequency of relevance for each of the 63 characteristics was presented with "Relevant Experience" and "Availability of Personnel." being the only items identified 100 percent of the respondents.

A second phase of the study involved reviewing the rating sheets for 13 evaluative criteria used in connection with proposals submitted leading to funded projects. Each of the 72 contracts originally had 1 to 13 proposals (author is inconsistent on the latter number) submitted to it. The dependent variable used in analysis was the total points assigned out of a possible total for all criteria. A total of 240 proposals, 125 accepted and 115 rejected, were used in the analysis. These proposals represented 48 of the 72 contracts. Discriminant analysis and t-tests were done on each evaluative criteria. A step-wise multiple regression was also done on the evaluative criteria. The results of the t-test for the 13 evaluative criteria showed the differences were all statistically significant except for Information Sources and Past Performance. The stated results are at variance with tabled results which show that Data Collection has a p value of .604 and Past Performance with a p value of .000. The results from the discriminant analysis were presented in terms of highest overall predictability of group membership for each individual evaluative criterion. On this basis, Experience with a Particular Agent has the greatest predictability with 80 percent of acceptable proposals predicted correctly and 71 percent of unacceptable predicted correctly. Items such as Study Site Selection, Sampling and Analysis, Past Performance, Information Sources, and Data Collection were in the 50 percent area of predictability. It should be noted that in many cases the discrimination was based upon comparing the accepted and rejected proposals numbers even though number of proposals rated on each of the criteria varied from 113 to 236.

In terms of the regression analysis, results are presented showing that the R-square ran from a +.38 with one variable, Technical Merit of the Approach, to +.76 with the addition of the last evaluative criterion of Past Performance.

In summarizing the findings, Howarth notes that of the 13 evaluative criteria, nine predicted correct group membership at levels from 98 percent for Plans for Data Collection Analysis to 76 percent for Availability of Proposed Staff. Because of the variable number of proposals rated on the several evaluative criteria, she noted that more reliance can be placed on the Specific Experience criterion since it was rated on 236 proposals than on the Data Collection criterion since it was rated only on a few proposals. Three criteria were considered as poor discriminators; Thoroughness of the Proposed Approach, Technical Competence in Sampling, and Past Performance. In turn, these predicted unacceptable proposals at a high level of membership. Based upon the results of the discriminant analysis and the regression data, the author believed that the results were generalizable to other contract proposals employing similar evaluative criteria.

### Applicant Feedback.

Once a proposal has been submitted, reviewed, evaluated, and a funding decision made, applicants are notified of acceptance or rejection. Typically, winners do not seek information or feedback about their proposals but losers desire to know on what grounds or basis their proposal was rejected. Two studies were identified that relate to the feedback situation and are the subject of this section.

To examine the nature of the feedback provided by funding agencies to rejected applicants, Heathington and Teague (1980) solicited information from 127 faculty members in higher education insitutions. The faculty members were from the areas of health science, engineering, education, and business who had proposals rejected by NIH, NSF, OE, NIE, National Endowment for the Humanities, and National Endowment for the Arts in fiscal 1979. Responses were obtained using a 16 item questionnaire. Of the group surveyed, 117 or 92 percent had previously submitted a proposal with the average being 5 submissions. The group of 127 averaged two federal grant awards with 28 percent having not received a previous award.

Follow-up requests for information regarding their proposal were made by 74 percent of the applicants. Fifty telephoned, 38 sent letters, and 6 arranged for personal meetings. Reviewer worksheets were sent to 54 persons, an agency summary sent to 30 others, and 8 talked personally. Fifty-seven percent of the respondents received responses within two weeks and an additional 33 percent received responses in four weeks.

While no data is presented with regard to frequency, the authors noted that the rejected applicants' reactions, after examining the reviews, clustered around five major reactions: the differences among reviewers, the differences between review panels, non-constructive or overly general comments, the qualifications or credentials of the reviewers, and the possibility of a closed network or in-group. Recommendations for improving the feedback process were presented.

The prior report focused primarily upon reactions of rejected applicants. The study by Rogers and others on small grants cited earlier collected data with regard to the review and feedback process from both applicants and reviewers. Applicants' responses were gathered on such items as length of time to decisions, how they were notified, reasons for rejection, and availability of field/reader comments. Of the total applicants, 40 percent thought the funding decision took Considerably Longer than expected, 27 percent Somewhat Longer, 29 percent saying About What Was Expected, and only 5 percent saying Less than Expected. Applicants not funded were asked if they requested an explanation of the decision and 71 percent indicated they had. The response most frequently given was Poor Design (39 percent) and Lack of Educational Significance (32 percent) with other aspects receiving lesser amounts (7 to 4 percent). No explanation was provided to 21 percent of the not funded applicants. When asked if the field reader comments should be sent routinely to each applicant, approximately 85 percent of both funded and nonfunded applicants felt they should. The field readers also supported this idea but the percentage was lower with only 59 percent indicating they should go to every applicant. In terms of satisfaction with the explanation, 81 percent of the non-funded applicants seeking an explanation checked "Not Satisfied." Respondents were asked about the criteria used to judge their proposal and 577 or 87 percent indicated that the criteria were appropriate.

The survey form completed by the field readers solicited information relative to a series of demographic items such as major field, distribution of professional time, number of proposals submitted, and number of dissertations directed. Of the total responses, 339 or 80 percent indicated that they were under contract as field readers, the modal number of years for being a field reader was 3, and the most frequent number of proposals reviewed as 6 to 14. The mean time for reviewing a proposal as individual field reader was 3.49 hours but when reviewing to get ready for a panel meeting the mean time was 1.72 hours. In view of the relative size of the proposals, the field readers indicated that on the average about 15 proposals would be an optimum number for a panel to review in one day. Field readers were also asked about the nature of the RRP and their suggestions for improvement of the program. The reader is referred to the study for details on these related items.

In discussing the findings with regard to the proposal review, decision and feedback process, the authors noted that there were administrative problems such as budget freezes which created difficulties for rapid processing. The authors noted also that the program never had what might be called a "typical year" and the utility of the results of the small grant study are limited for that reason.

Commentary

The studies cited in this section have focused upon the process of selecting a set of proposals for funding from a larger group submitted. In contrast to possible organizational settings which utilize more objective models for selection, the settings reported here are primarily ones involving a largely subjective judgemental process wherein peers are used to rate proposals against a given set of criteria. It was interesting to note that no study was identified that sought to establish evidence about the validity of the criteria or their relative weighting in terms of a total. Some evidence was obtained that informal as well as formal initial screening procedures were used. Investigation of the actual process of making judgements in real-time was examined and indicated that the information exchanged among the members of a peer panel as well as who offered the information had some influence upon the final ranking of a proposal. To further assist in making necessary judgements, comparisons were made between accepted and rejected proposals with various elements being examined to see if a consistent set of elements could be established. Only limited study has been made of the important feature of the review process of providing feedback to applicants as to reasons for rejection. In some instances, no such feedback was provided while in other instances helpful information was presented. In view of the observation that judgement of individuals plays a major role in making final funding decisions, it would seem apparent that investigations should be made upon the factors relating to the judgements being made. The next section examines some of the studies and reports which have questioned the credibility of the peer review system, particularly within academic settings.

## VI. ESTABLISHING CREDIBILITY OF THE PEER REVIEW PROCESS

While one cannot state with absolute assurance, it is quite likely that the general model of peer review for proposal evaluation has its origins in the colleagual evaluation system employed in academic settings for making judgements about promotion and tenure, the selection of research reports for publication in scientific journals, and similar situations requiring the use of expert judgements in specialized disciplinary areas.

The process, while generally accepted, has not been without question. Several studies were identified that report on the credibility of the peer review operation. One set of studies has focused primarily upon the peer review as it operates in Federal funding agencies. A second set has focused upon an examination of factors or variables which have been investigated as a response to charges that the system is biased. These two sets of studies comprise this section of the report.

### Intra-Federal Agency Studies

The use of peers as the principal means of evaluating the scientific or technical merit of proposals has been employed by Federal funding agencies since the turn of the century (NIH, 1978). Vandette (1977) and Carter (1974) have reviewed and traced the numerous Congressional hearings with regard to the operation of the process and the validity of its judgements. These studies have been initiated because of such charges as favoritism, cronyism, "old boy" networks, and political influence (Gross, 1976). Three studies involving peer review operations within Federal agencies were identified. The agencies involved were the National Institute of Health, National Science Foundation, and Department of Education. Each report is summarized below.

National Institute of Health Study. Because of the important role that peer review has in the support of its extramural research funding, the National Institute of Health in 1975 established an internal NIH Grants Peer Review Study Team. The Study Team was charged with examining the current system, exploring alternatives, and making recommendations for any changes. The results of the Study Team's efforts are contained in two documents in the form of reports to the Director of NIH. The first document titled Phase I (NIH, 1976) consists of three volumes. Volume 1 summarizes the principal results of the study along with recommendations. Volume 2 contains a variety of background materials. Volume 3 consists of supplemental material relating to the preliminary analysis of data collected. The Phase II report (NIH, 1978) presents a more detailed analysis of the data collection and is viewed as a support document for the Volume 1 of the Phase I report which is considered the major document produced by the Study Team. Comments presented here have been selected from both sources.

As noted, the initial effort to study the NIH peer review system started in 1975. The basic process used by NIH is two-tiered; an Internal Review Group initially judges the scientific significance and technical merit of a proposal and assigns it a technical merit priority score. The National Advisory Councils review the technical merit recommendations and make final reviews for scientific merit. The Councils also make recommendations as to program relevancy and funding priority. Three major means of securing perceptions about the peer review system were used by the Study Team. One involved a survey of the 1975-76 review groups, a second involved a series of hearings, and a third was a solicitation of letters.

The survey form or questionnaire of review group members consisted of a section on demographic data, followed by a section on the assessment of the current system, one on the impact of recent and future changes in the system, and a section on suggestions for improvement. In 1976, the Study Team distributed 1,354 questionnaires to 12 Advisory Councils, 51 Internal Review Groups of the Division of Research Grants, and 24 Institute Internal Review Groups. In addition, the survey was also given to liaison members representing federal agencies and *ad hoc* consultants (both representing 13 percent of the total survey group). The overall response rate was 94 percent. No survey forms were sent to applicants.

Respondents were asked to rate aspects of the current system from Excellent to No Opinion. The results of the analysis are presented in terms of the percent of the persons responding. Each item had a focused stem followed by a series of specific items related to the stem. The results are presented in tabular form organized so that the general specific items receiving the largest percentages are presented first followed by lesser percentages. Further, the items have been grouped into major percentage categories (e.g., 90 percent or more responding Excellent/Good). On this basis, the Phase I report highlights the following items as having the strongest endorsement:

- Lack of general bias
- Lack of bias against minorities, young

investigators, or women in recent years

- Overall adequacy of current review in general for traditional research grants
- Adequacy of the current review system for scientific and technical quality of new grants and the capability of research investigators
- Value and quality of site visits in the review process
- Performance of peer groups in discussion of applications and their behavior during the review process
- Scientific and technical members qualifications and performance
- NIH staff qualifications and performance in administering the system

Those statements being viewed as having weak endorsement (those having 80 percent or less of all review group members) were as follows:

- Some bias towards "cronyism"
- The review of program project and center grants was judged less adequate than traditional individual research projects review
- Adequacy of review for program relevance was judged Excellent or Good by only 67 percent
- Reviews for budget appropriateness and essential collaborative arrangements were judged more favorably by Initial Review Groups than by the National Advisory Councils
- Time available for site visits was least favorably rated by the IRGs who are responsible for such visits
- The priority score ranking system apparently posed problems of understanding
- Current restrictions on applicant notification has sizeable opposition

- Time available for review appeared to be an area of some dissatisfaction
- Working conditions for Study groups were viewed less favorable by DRG groups than by other review groups
- Selection process for peer review group members was not heartily endorsed since less than three-fourths view it as Excellent/Good.
- Public members' performance was rated Excellent or Good by about two-thirds of the National Advisory Councils

The report highlights two items having the least support. Both were related to applicant notification. Only 56 percent found favorable the current requirement prohibiting informing the applicant of the priority score from the Initial Review Group. Only 69 percent found favorable the requirement of delaying the notification of the overal Initial Review Group recommendation until the final review by the National Advisory Councils.

In addition to the survey, the Study Team conducted three hearings around the country and also solicited letters from 30,000 interested parties. A total of 1,400 persons wrote letters and 93 persons presented oral or written testimony at the hearings. The Phase II report notes that the characteristics of the correspondents differed from the witnesses in almost all dimensions of obtained information. Witnesses were more often from formal organizations and included a higher proportion of women and individuals who had never applied for a grant. Correspondents were primarily faculty from higher education institutions. The data suggested, as the Phase II report noted, that the witnesses were less knowledgeable about the system and less successful as applicants than were the correspondents. The comments presented by the witnesses and correspondents were analyzed by identifying 12,065 comments, classifying them into 106 topics, then into 64 categories, and finally into 11 major subjects. The summary of strong points noted by correspondents and witnesses showed that 83 percent of the correspondents approved of the system while 73 percent of the witnesses approved of the systems. About 14 percent made comments about the presence or absence of bias indicating they felt the system was not biased in general or unbiased towards women and minorities. Notation is made in the Phase II report that the responses from the letters and hearings do not represent a scientific sample while the survey results are considered more valid in that they were considered as a representative sample.

While the two reports contain recommendations for improvement of the system, overall the three groups of persons involved in the survey (reviewers, correspondents, and witnesses), generally view the current peer review system as a satisfactory and reasonable way to evaluate grant applications. It was noted in the report, however, that individuals with the most experience with the system were more favorably inclined and that the grant review groups were more favorable toward the current system than were the witnesses and correspondents.

National Science Foundation Study. A second study examining the general overall function of the peer review process as a vehicle for proposal evaluation was that conducted by Vandette (1977) using the National Science Foundation operations as the data source. The focus of the research was upon the "agency-to-individual" as contrasted to the "agency-to-institution" mechanism since the former makes use of either an individual or peer review panel in making final decisions. Four questions directing the research sought to determine whether or not the peer review system provided for the advancement of science in the most effective way, if the process was fair and impartial or subject to political influence and geographical favoritism, if it was economically feasible, and if it promoted "grantsmanship" and is too secretive.

Testimony from oversight hearings held by the Congressional Subcommittee on Science, Research, and Technology in 1975, a study of past trends and policies and practices with regard to the award of NSF grants, plus 16 personal interviews with different government and educational sources including NSF serve as data sources. The interviews consisted of 3 persons from NSF, 6 from the National Institute of Education, 6 peer reviewers, plus 1 person from the National Association of State Universities and Land Grant Colleges. Interviews were both taped and written.

In summarizing the results, Vandette notes that while the peer review system has faults no method superior to it has been found for judging the competence of proposals and that its positive aspects should be enhanced. In terms of promoting the advancement of science, the author concluded that the peer review system could do more in seeking out and supporting innovative research. In responding to the question of fairness, the author concluded that there was perhaps some truth to the charge that there is some geographical/institution bias with regard to sources of peer reviewers. Tables are presented in the text showing the distribution of reviewers by geographical regions, institutional sources, and publication rates. The author noted that patterns of funding in NSF tend to give a strong advantage to prestige institutions. In discussing this observation and the possibility of such a circumstance occurring, the author raised a question of scientific merit versus equity. He also noted that there is probably no real way to satisfy the critics of the system on this point. No real conclusion was drawn on the questions relating to the cost of the peer review system although the results seem to suggest that it is justified. In terms of opening up the system (e.g., making the names of reviewers public), the author concluded that the system would be harmed by such an action. He notes that the Congress itself in the NSF hearings suggested going slow on this type of action. In a final note, Vandette feels that confidence in the peer review system clearly exists and, while not perfect, it is the most feasible system devised.

Department of Education Study. In response to requests from committees of the House of Representatives, the General Accounting Office did a review of the procedures used to award discretionary grants on selected programs (GAO, 1983). The GAO was asked to secure information on the legislation and related items that governed the grant award process, the establishment of funding priorities, the recruitment and selection of field readers, reader selection criteria, reader training and orientation, procedures for reviewing and ranking applications, differences between reader rankings and final selections, procedures used to determine final grant amounts, and percent of requested funds received in 1981 and 1982. In addition, the GAO was to compare 1981 and 1982 competitions for selected programs with special emphasis on the composition of field readers.

The GAO report examined three program activities:, the Women's Educational Equity Act Program, the Unsolicited Program of the National Institute of Education and a set of three programs under Talent Search. Details are presented regarding the process of awarding grants along with the selection and composition of field readers for each program. For purposes of this report, attention will be given mainly to the operations relating to the selection of field readers as they operated within each program.

In reviewing WEEAP field reader selection, it was noted that in 1981 an informal and unsystematic process was employed. In 1982, the program used the Field Reader Outreach Program of the ED in addition to its own procedures. For 1981, there was about 300 field readers while in 1982 there was a potential pool of about 400. There was a concern that continued use of the same field readers year after year resulted in a "liberal" bias and that the use of the Outreach program would provide readers with a more "conservative" philosophy. The report presents information comparing the 84 field readers used in 1981 to the 55 used in 1982 on sex, race, educational level, area of residence, and place of employment. The analysis showed that there were significant (sic) differences in terms of ethnicity, area of residence and employment. In 1981, 80 percent of the readers were Black, Hispanic, Asian American or Native American while in 1982 only 24 percent were from these groups. In 1982, more readers were from the Southeast and Midwest than in 1981. In 1982, there was a decrease in percent of readers from non-profit organizations and an increase in percent of unemployed and privately and self-employed persons. The report also notes that based upon a review of resumes, 1 of the 1981 readers and 11 of the 1982 readers did not meet selection criteria. In terms of sex, the percent of women was 86 for 1981 and 87 for 1982. As for the awarding of funds based upon ranks resulting from the field reader reviews, the GAO report states that in 1981 the WEEAP staff selected applications for funding based on the ranks as well as additional decision criteria. This resulted in applications for most priorities areas not necessarily being funded in rank order. In 1982, the awards funded the applications in their rank order. The report details the fact that in 1982 the selection of field readers was done by an Acting Assistant Secretary for Elementary and Secondary Education in the absence of the WEEAP Director. This condition could have resulted in both the contrasts in the 1981 and 1982 field reader composition and the awarding of grants in 1982 by rank directly.

In reviewing the National Institute of Education, the report notes that in 1981 the reviewers were selected by the staff from the program areas involved. In 1982, the program areas were directed to select part of the readers from a list compiled by the director of NIE. The field reader groups for 1981 and 1982 were compared on the basis of sex, race/ethnicity, and knowledge of educational research using randomly selected information sheets from each reader. Of the 50 out of 205 reviewers used in 1981, 60 percent were White while in the 1982 group of 272 reviewers, 75 percent of the 60 files examined show White ethnicity. As for sex, the group from 1981 showed 54 percent male while it was 65 percent male in 1982. In examining credentials for an understanding of educational research, it was noted that there was not sufficient information to permit a determination of research competency for 53 of the 205 reviewers in 1981 and for 32 of the 272 readers in 1982. As for funding based upon rank order, five proposals were funded in 1981 but not as in the final rank order. In 1982, there was some variation by program area but in the unsolicited proposal case, 13 proposals were selected for funding that were not part of the top 17 ranked. Deviation from the final order was justified on the ground that 2 addressed an ED priority, 5 supported the NIE mission, and 9 offered unique research opportunities.

Examination of the Talent Search procedures noted that the field reader selection was done by randomly selecting 200 readers from a file of persons identified as qualified to read applications for Talent Search. Comparisons were made between the 1980 and 1982 groups on the basis of sex and ethnicity. In 1980, there was 69 percent male while in 1982 it was 53 percent males. In 1980 there was 57 percent White and in 1982 there was 32 percent White with Blacks showing an increase from 29 to 45 percent. Of the total set of 268 ranked projects, 159 were recommended for funding and these were essentially as in rank order. Due to subsequent availability of funds, lower ranked projects were also funded.

The report does not present any conclusions about the relationship between field readers, their recruitment and selection, and the process of grant awards. It presents the findings above as fact leaving the reader to draw his or her own conclusion. For purposes here, the findings suggest that the compositon of peer panels in various programs of the Department of Education has diversity in how they are selected and their demographic characteristics. There is also variation in the manner in which the results of the field reader rankings are related to the making of final awards. The findings also note that factors other than the public evaluation criteria are used in making final awards after rankings are obtained from the field readers.

### Studies Relating to Potential Peer Bias.

Even though the internal studies present evidence about the credibility of peer review, charges about bias in the award process do exist. Four studies were identified that were aimed at substantiating or ruling invalid such charges.

Liebert (1976), using data from a 1972-73 American Council on Education survey of 259 senior colleges, examined determinants of grant-getting on a national basis. A total of 5,687 individuals, or a 15 percent subsample was drawn from 40,421 responses. This total was reduced by eliminating those with the highest degree earned in the last two years or where there was no data on grants or productivity leaving a balance of 4,949 cases. An item asking about the number of agencies from which grants were secured as a measure of grant-getting plus two productivity items on the ACE form relating to total number of published articles and manuscripts published or accepted in the last two years were used as independent variables.

Using path and regression analyses, the author noted that other than field and productivity variables not much else made any difference. He noted also that the weak relationships did not support claims of institutionalism and the need to have agency contacts. In summary, Liebert found that the distribution of research grants was more competitive with regard to individual productivity criteria than it was biased by field favor. There was little evidence of situational or personal particularism in the sample studied.

In connection with the analysis in 1975 of vocational education proposal awards, Wilson (1976) analyzed the relationship of selected rater characteristics to proposal ratings. The specific characteristics investigated were sex, ethnic group membership, highest degree earned, field of degree, and place of employment (Office of Education, other federal agency, educational agencies, and non-educational agencies). A total of 29 raters were involved in the study. Mean scores for each rater over all proposals they rated were determined along with mean ratings for subsections of the proposals. One-way analysis of variance was employed on each characteristic.

There was a significant difference on the rater ethnic group membership at the .10 level with American Indians giving the highest mean ratings followed by Whites, Blacks, and Hispanics in that order. Differences by earned degree were significant at the .05 level with MeD degrees having the highest mean rating and the PhD group having the lowest average rating. In terms of employment location, there was a significant difference between Office of Education and non-Office of Education employees at the .05 level with OE personnel having a higher mean rating. Office of Education raters also had significantly higher means at the .05 level than did raters from other Federal agencies. There were no differences for the characteristics of sex, field of degree, and employment in educational or non-educational agencies. While not true for all sections, the significance of mean ratings for subsections of the proposal tended to be correlative with the overall means ratings significance.

A third study relating to potential influencing potential factors operating in the peer review process was conducted by Ormiston (1977) in the field of education. The particular proposals of interest here were those submitted to the Basic Institutional Development Program of Title III of the Higher Education Act of 1965. To develop a background for the study, the author secured information about peer reviewers for the period 1968 to 1976. The fiscal year 1975 was selected to study in depth the relationships that might exist between reviewer ratings and institutional characteristics associated with the reviewers. In 1975, three panels at three time periods rated proposals on a 1 to 5 basis. A total of 58 peer panel reviewers were grouped according to institutional level (2 or 4 year), source of institutional control (public or private), and minority status (predominantly white or black enrollment). A separate group of 12 reviewers was classified on place of employment (education--other nongovernment agencies). The 480 applicants were also categorized on the same first three variables. A total of 18 questions guided the collection of data with Chi-square being the test statistic. In addition to ratings, data regarding funding recommendations was also obtained.

Findings for each of the 18 questions were presented in tabular form. As presented, no indication was given regarding the results of the Chi-square test leaving the reader to the conclusion that there was no significant relationship for each of the questions. The findings with regard to institutional level of the reviewer indicated no relationship between assigned reviewer ratings and level of institution being evaluated. There was an observed relationship in that two year institution reviewers tended to favor two year institutions while four year institution reviewers also tended to favor two year institutions. On the variable of public or private control, no relationship was observed between reviewer rating and control of institution being evaluated. There was a relationship in terms of recommendations for funding in that reviewers from private institutions tended to favor public institutions in their recommendations. As for the minority factor, there was an observed relationship between reviewer ratings and institution evaluated. Both white and black reviewers tended to give higher ratings to black institutions. In terms of funding recommendations, both reviewers from white and black institutions tended to favor predominantly white institutions in their recommendations. A separate analysis was made of the 12 reviewers coming from educational and non-governmental agencies. The results of this analysis were quite similar in ratngs and recommendations to those from higher education institutions.

Ormiston noted that 22 institutions received a perfect rating of 5 by the peer panel yet did not receive grants while 165 institutions with lower ratings did receive grants. In contrast, 11 institutions with poor or unacceptable ratings were funded. In terms of recommended funding amounts, one-third of the grants awarded were for less than 75 percent of the amount recommended by the peer panel. On the other hand, one-third received greater amounts than recommended by the panel.

In drawing conclusions from the findings, Ormiston noted that the ratings and recommendations appeared to be deprived of their value because of subsequent funding decisions made by program officers in BIPD. He conjectured that legislative restrictions and other program considerations led to such decisions. He noted also that the findings support a contention that a quota exists for predominantly black institutions for of at least 50 percent of annual funds. He noted that over the eleven years of the program, about 54 percent of the funds had gone to black institutions. He also stated that there is a geographical factor in that for fiscal year 1975 about 56 percent of the grants and 67 percent of the grant dollars went to Southern institutions.

Cole, Rubin, and Cole (1977) conducted what the authors refer to as a sociological study of the peer review process in the National Science Foundation. Their study was conducted for the National Academy of Sciences under funding from NSF but with complete autonomy from that agency. The report reviews the NSF peer review process along with the types of frequent criticisms about the system from a variety of sources. For many critics, the main factor is the organizational role of the program director in funding decisions, the director's freedom to disregard advisory council recommendations, and the freedom in selecting reviewers.

In order to delimit their initial efforts, the authors examined peer review as it operated in 10 basic research areas only excluding applied research and educational programs. Data were collected by interviewing 70 program directors, mail reviewers, review panel members, and related officials in all levels of peer review, plus reviewing the peer comments on 250 research proposals and related correspondence, and conducting a quantitative analysis of 1,200 applicants in fiscal year 1975 when about half were being funded.

Several different hypotheses were examined. One focused upon the charge that the "old boy" network operated in that eminent scientists were rated more favorable by eminent reviewers than by other reviewers. Both applicants and reviewers were classified according to prestige of department from 1969 ACE ratings. The analysis showed that applicants from high ranked departments received slightly better reviews than did applicants from medium and low ranked departments. Using analysis of variance procedures, the observed mean rating for each applicant-reviewer pair was compared to expected mean rating assuming no bias. The result showing no disproportionate favoring by raters in high ranking departments of proposals from other high ranking departments. Analysis was done for each of the 10 programs on the same issue with only one area showing more leniency toward high ranked departments. An analysis of reviewer bias in terms of geographical location of reviewer and relative eminence of reviewer and applicant was made. There was no significant tendency to favor proposals from one geographic area over another or for eminent scientists to favor proposals from other eminent scientists over less eminent scientists.

A second hypothesis about the "rich getting richer" was examined by looking at the characteristics of the applicants on nine variables used to define their status in the social system of science. Each variable was examined separately. The results showed only weak or moderate correlations between the nine social status variables and ratings received on the proposals. The most highly correlated variable was the number of citations in the 1975 Science

Citation Index with only 6 percent of the ratings variance explained. Over all variables, only 11 percent of the variance was accounted for.

The amount of agreement between mail reviewers was examined by looking at the mean standard deviation of reviewers' comments using the coefficient of variation. These ranged from .13 to .30 in the several areas. The results were the same when correlating the mean rating as a dependent variable and nine independent variables. The authors concluded that the mail reviewers were not persuaded by professional status of applicants, and were more likely to be influenced by quality of proposed research.

In response to the question what types of scientists received grants from NSF in 1975, 62 percent of those receiving their degrees from the highest ranked graduate departments received grants compared to 38 percent graduating from lowest-ranked departments. Further, 74 percent of applicants currently employed in the highest ranked departments were funded while only 38 percent employed in unranked or non-academic institutions were funded. Recent NSF funding and citations of recent work had a moderate influence while professional age had almost no effect.

The general structure of the findings indicated that scientists with an established track record, many scientific publications, a high frequency of citations, a record of having received grants from NSF plus ties to prestigious academic departments result in a higher probability of funding than do other applicants.

The authors introduced the sociological concept of "accumulated advantage" and tested it by comparing the mean peer review ratings after dividing applicants into three groups; those with high, medium, and low mean ratings. Considering only those proposals receiving the highest peer ratings, estimates of probability of funding was established based upon the number of citations. Of the quintile with the highest number of citations, 100 percent received grants for while the lowest quintile only 77 percent received grants. The authors conclude here that mean peer rating was more important in funding than number of citations. In summary, the authors believe their results are consistent with other findings in the sociology of science that, while a highly stratified social system (Cole and Cole, 1973), the science enterprise is an equitable one favoring those who produce quality work.

As Cole, Rubin, and Cole previously pointed out in their study, citation of published research is considered by many scientists to be an indicator of the value of the work performed. Citation in terms of the number of times a particular piece of research is cited as well as the total number of cited publications are often used as criteria for making judgements about the influence that a particular scientist has had upon a discipline. In a report on NIH research policies, Carter (1974) studied the validity of the peer review judgements by using two measures of research output-approval of renewal applications and citation rates. The projects involved were those awarded to medical schools in the period 1968 to 1973.

The first analysis made was of the relationship between priority scores awarded on initial application and the priority score on renewal applications. The correlation coefficient between the priority scores for the same grant was around +0.4. In interpreting this relationship, Carter suggested that the uncertain nature of research as well as the willingness of reviewers to be critical even of well-established investigators are prime factors in the low relationship. She noted also that the rate of disapproval of renewal applications declined over the period 1968-1973 and attributed this to better quality applications. She also noted that the increasing approval of renewal applications over time provided objective evidence for supporting the concept of "scientific merit". In looking at ratings on new and earlier applications for the same individual, she found a statistical relationship but noted it was of such a nature that the major portion of the variance could be attributed to the merit of the project.

The phase of the investigation involving citation data was done by using 747 research project grants and all 51 program project grants awarded to medical school faculty competitively in fiscal 1967. Information on publications from these grants was obtained from the Research Grants

Index and the Science Citation Index of the Institute for Scientific Information. The Grants Index provided a list of about 5,800 publications from 1966 to 1970 while the Citation Index supplied a listing of all 40,000 citations listed in journals cited in the Citation Index from 1968-72. When the production of at least one frequently cited article was used as a citation measure, 116 grants or 15 percent of the total each had produced at least one of the most-cited 5 percent of the articles in the sample. The priority scores on renewal applications for this set of grants was 47 point higher than would have been predicted from the scores awarded in 1967. Carter suggested caution in using this finding as evidence that citations are a measure of research quality. She suggested that the evaluation of renewal applications could be strongly affected by results from the prior grant period. In examining the set of grants, Carter noted that the reviewers apparently perceived the results would be more useful since this set was awarded a better than average priority score, received larger average dollar awards, and had a commitment for a longer time period than average than did other grants in the sample.

Recognizing that publications were from one set calendar period and citation rates from another set, a model was constructed to adjust the number of citations retreived to account for the year of publication. The model estimated the number of citations that would occur in year $i$ after publication for each $i$ in $\{0,6\}$ for which data were missing.

An estimate of the standard error of prediction of T (the total number of citations of an article that have or will occur in years 0 thru 6 following publication) was derived as a function of the year of publication. More than 95 percent of T was explained by available data and the model for years 1966, 1967, and 1968. For articles published in 1968, only citations for years 0-4 were available but that these data could predict citations in year 5 and 6 with only small error.

Using average citation rates to journal articles, each grant was assigned to one of three categories based upon the principal investigator's department in the medical school. For grants in each of the categories, the priority score received on the renewal was regressed on output measures (average citation rates, total citations, etc.). For the departments with lower than average citation rates, no output measure was found to be significantly correlated with the second priority score. For the basic science group and the medical groups, the relationships were not strong enough to choose one over another. Average citation rate was better than total citations and citation in journal articles appeared to be more important than citation of other publications. Publication count was found not to be related to the second priority score for any category. Carter noted that after citations have been included, the number of publications does not appear to be an additional measure of research quality. From the several regression analyses, the variable of "average number of citations of all publications that were cited at least twice in the six years following publication" was chose to represent research quality. On this basis, the citation data were observed to be related to the priority score awarded in 1967. The author noted there that this relationship was further evidence that the concept of "scientific merit" is not completely subjective. She noted further that while the initial and renewal priority score relationship was low as noted there was a stronger relationship between the citation measure and the renewal score.

In a subsequent paper, Carter (1978) presented data with regard to whether or not medical schools received money because of their excellence in research or because of favoritism. Using regression analyses with citation rate as a dependent variable and renewal priority score as predictor, the findings indicated that the average priority score on renewal applications was different for most research intensive schools after controlling for research output in the previous grant period. The citation data suggested also that the favorable judgements are explainable by research quality and not by being related to a research intensive school. With original priority score as a dependent variable, applications from research intensive schools were better even after controlling for citation rate.

### Commentary

The importance of the function and structure of the field reader and/or peer review system cannot be too highly stressed. The consequences of being the recipient of a grant or contract can be both personal and professional. The granting of an award can mean movement ahead in a research, development, training, or social program effort with subsequent recognition of the results. The lack of such funds can often mean delays in moving ahead on personal goals and often a diminishing of institutional rewards.

In view of its importance, the several studies reviewed here have attempted to demonstrate in one form or another than the system does have credibility. Proposals that are approved and granted funds do appear to have scientific and technical merit at the time of funding and also produce useful results at some later time. Charges of cronyism, old boy networks and related biasing factors tend not to be substantiated. There is evidence that a set of prestige institutions and perhaps even individuals receive a large share of the awards but the same evidence indicates that these sources also are the ones producing quality research efforts. They have produced good work because they have attracted quality personnel. Thus, they have what the sociologists call an "accumulated advantage" in the competition for funds. While there may be limitations to the peer review system, it appears over time to have developed a sufficient basis of credibility to be continued as the prime vehicle for reviewing and evaluating proposals.

submitted for funding.

## VII. PROPOSAL QUALITY AND PROGRAM SUCCESS

One aim if not the paramount aim of both informal and formal review processes is to aid in establishing relationships between the quality of a proposal and the resulting success of the approved program or project. The study by Carter on relationships between peer review judgements and the resulting citation of research results is an illustration of this objective. Two studies that sought to provide evidence on the relationship between proposal quality and subsequent program results are reviewed in this section.

### Proposal Quality and Final Reports

In a study funded by the Indiana State Board of Vocational Education (1979), an investigation was made relating the quality of an initial proposal to the subsequent final project report. Using 60 projects funded by the SBVE during fiscal year 1976-77, both the content and format of the proposals and final reports were examined using rating scales for each dimension. A correlation of +.59 (p = .001) was observed between quality ratings scores for the proposal and final report.

It was noted that those sections receiving the highest ratings in the proposal were those relating to the availability of specific guidelines and instructions. Those sections of the proposal and reports open to more conceptualization tended to receive less credit. In an attempt to establish predictors of project quality (i.e., combined proposal and final report ratings), the proposals were categorized by the presence or absence of credit for several items representing sections of the proposal. Overall mean scores were then compared for items receiving credit and those not receiving credit. Only the item "Objectives are Clearly Written and Specific" was found to be statistically significant using a two-tailed t-test. It is interesting to note that in the table reporting these results, the item "Procedures are Provided with Sufficient Detail" had a larger between-means difference yet no results are presented with regard to the outcome of the statistical test for this item.

In addition to the above, an investigation was made of the readability of both proposal and report formats and their comprehensiveness. It was found that the mean scores for readability were higher than for comprehensiveness. Because of the frequency with which they occurred in the proposals, an examination was also made regarding the role of advisory committees, literature reviews, and instrumentation. The results showed that, in general, insufficient information about these items was present in both proposals and final reports.

In the summary, the report stressed a need for more specific guidelines in the areas relating to the conceptualization of the research studies. They noted also that their analyses demonstrated that various sections of a proposal can give indications of the subsequent quality of a proposed project.

## Proposal Quality and Program Implementation

Recognizing the importance of having successful projects as a means of accomplishing program objectives, Toia (1974) investigated the relationship between four factors which might affect both securing an award and the successful conduct of program implementation. The four factors were the administrative relationship existing between the grantee agency and the local government, the educational and prior experience of the professional staff of the grantee agency, the amount and type of technical assistance used in preparing the proposal and in program implementation, and the similarity of staff characteristics to client characteristics. These four factors or criteria were related to the quality of the proposal and the success of the program implementation after funding. A group of 16 proposals funded in Fiscal Year 1971 under the Youth Development and Delinquency Prevention Administration constituted the data for analysis. Each proposal was ranked by five panel members independently and then in a joint session. A quality rating score and final rank for each proposal was obtained by summing the rankings for the five panelists. A measure of the quality of program implementation was developed and submitted to the project directors and non-clerical employees of the project. Raw scores for each agency on the independent variables was established and then correlated by multiple regression separately for the independent variables. In addition, the correlations were obtained for quality rating and rank on proposal and program implementation.

The analysis revealed that the correlations between proposal quality and program implementation ranks was negative (-.33797) using an interval scale approach and -.3367 using a rank order analysis. The author attributes the negative relationship to the possible use of consultant proposal writers possessing little or no relation to the real world and who may have focused on developing a proposal that would "sell".

The relationship between program implementation ratings and the four independent variables showed all four as significant with educational background of staff accounting for 46 percent of the variance. For all four factors, 75 percent of the variance was accounted for with administrative relationships the second variable followed by technical assistance and then personal characteristics. These same four variables when correlated with proposal quality showed no significant relationships with technical assistance only accounting for most of the variance (4 percent). Adding the other variables accounted for only 8 percent of the total variance.

In discussing the findings, the author noted the discrepancy between proposal quality and implementation ratings and indicated that the proposal quality rating was a poor and imperfect predictor of program implementation success. The author stated that those agencies who invested in their professional staffs appeared to be the ones most likely to be successful.

Commentary

It is interesting to observe the lack of studies relating proposal quality to subsequent program success. In view of the interest in increasing predictability, the results presented are not consistent, in one case, the relationship between proposal and final report was positive while in the other the relationship between proposal and program success was negative. The positive result might be explained by the similarity between proposal and final report components. If the objectives are well stated in the former they are likely to be also in the latter. In contrast, the factors examined in relationship to proposal development (such as Technical Assistance) could very well not be related to the kinds of efforts needed to make a program successful. Thus similarity of variables examined leads to a positive result while dissimilarity leads to negative results.

## VIII. PERCEPTIONS AND ATTITUDES ABOUT PROPOSAL DEVELOPMENT

Proposal development and evaluation, like many another process generates a series of beliefs, attitudes, and perceptions about what it takes to be successful. One often hears stories about how an individual received a large amount of funds by simply sending in a proposal on the back of a post card. There are also stories that RFPs merely comply with bid competition and that the contract for substance of the RFP has been "wired" - some agency or individual has previously been identified as the winner. At the same time, there are some realities to proposal development. Certainly one is the missing of a mail or submission deadline resulting in a rejection of the proposal. Another would focus around the failure to properly read a program ammouncement and thus not respond to a priority area. Two studies were identified that investigated this area of proposal development. One study focused upon a general recommendation made to proposal developers while the second focused securing attitudes toward the overall process of development and evaluation.

### Perceptions of Funding Agency Behavior

One common recommendation in the literature is that prospective proposal developers take time to review what an agency has funded in the past as a guide to knowing if one should submit their ideas to that agency.

One study relevant to this point was done by Siegel (1977) in securing perceptions held by agencies, who were often the recipients of funds from foundations, as to the factors which governed acceptance or rejection of proposals by such foundations. Using a questionnaire approach, 90 agencies in Franklin County, Ohio were solicited with regard to reasons perceived by them for acceptance or rejection of proposals by foundations. Seven research questions directed the study. Sixty-eight agencies returned the questionnaire for a return rate of 76 percent. One follow-up was made. Thirty-nine of the completed forms were from private agencies seeking funds, 24 from public, and 5 from quasi-public agencies. Demographic data regarding responding agencies are presented in the report. Of the group responding, 48 or about 72 percent had applied for a grant but 19 had not. Of the 48 applications, 28 had received and 20 had not received a grant. Data is based only upon the 48 responding Yes and consists of descriptive statistics and Chi-square.

With regard to source of funds, 32 or 71 percent felt that their chances were best to get money from the local level as opposed to other levels. As to topics most easily funded, the general finding was that grants for the handicapped were easiest followed by child abuse. With regard to type of grant (on-going, one-time, or matching), on-going grants were perceived as being the most difficult to secure (37 percent) and one-time grants the easiest. Seventy-five percent felt that proposal writing was a necessary administrative skill within an agency seeking funds. As for importance of the various sections of the proposal, the specification of objectives and the budget were perceived as being most important (77 and 79 percent respectively) to funding agencies.

In terms of perceived reasons for rejection, the highest percentage was for the request being improper or ineligible (36 percent), lack of planning for future spending (38 percent), lack of measurable need (33 percent), staff experience (26 percent), with other reasons receiving fewer responses.

Respondents were also asked to rate a series of items expressing views about proposal preparation as they relate to securing foundation grants. Of the 48 respondents, 42 Agreed or Strongly Agreed with the statement "Knowing foundation staff contributes to grant acceptance"; 33 percent Agreed or Strongly Agreed with the statement "Getting foundation proposals accepted usually involves political considerations"; 36 were either Uncertain or Agreeing with the statement "Who you are, as an agency, determines grant acceptance"; 35 responded similarly to the statement "There is a formula for getting proposals accepted"; 29 responded Uncertain or Disagreeing with the statement "There is a diverse community representation on most foundations boards"; and the responses were about equally divided between Disagreeing and Agreeing with the statement that "There is a mystification surrounding grant proposals".

In terms of the original seven research questions, Siegel makes the following summary: On-going grants were perceived as being the most difficult to secure; most agencies that do not actively research foundations do not get proposals accepted; grant proposals are rejected most frequently due to improper or ineligible requests; getting foundations proposals accepted usually involves political considerations; knowing foundation staff personnel contributes to grant acceptance; there is a formula for getting foundation proposals accepted; and that the introduction section of a proposal was not most important to the funding agency.

## Myths and Realities

Recognizing that proposal development may have its myths and realities, Cook and Loadman (1982) initiated development work on instrumentation to assess perceptions and attitudes about proposal development and evaluation. Drawing upon personal experiences and the large literature base on proposal development, a series of statements were created to reflect both myths and realities. An initial set of 86 statements was created and administered to individuals at the university level attending workshops and enrolled in courses on proposal development. Using factor analysis procedures, the statements were reduced to a final set of 54 items scaled in Likert format with a score of 1 representing Strong Agreement and 5 representing Strong Disagreement with the statement. The final set of scaled items was mail administered to a systematic sample of 419 individuals listed in the 1979 Biographical Membership Directory of the American Educational Research Association. A total of 231 subjects returned usable responses. Each respondent was asked to provide data with regard to proposal development experience, membership on peer panels, operation of projects, and the conduct of proposal training sessions. The responses of the 231 subjects were factor analyzed and five factor scores generated. The reliability of the five factors ranged from +.49 to +.83. Respondents were classified into groups based upon their proposal development and peer panel experience. Discriminant analyses were made but the resulting classification functions did not predict group membership at anything better than a chance level. Consequently, emphasis was given to examination of the items as contrasted to factor scores.

Using the 54 items as predictor variables and classification variables of peer panel experience (including proposal development) against no peer panel experience, a stepwise discriminant function was made. Of the total item set, 19 items correctly classified group membership at a 72 percent level. The resulting analysis suggested that the perceptions of persons having had peer panel experience differed in their responses to the instrument than those who had not had the experience. To develop some sense of myth and reality, items were classified using the mean score from all respondents into endorsed (high agreement), non-endorsed (low agreement), or neutral statements. There were nine items receiving strong endorsement. They were viewed as representing reality and are as follows in shortened form:

- know the funding source

- write clearly and precisely
- the proposing agency reputation makes a difference
- the understandability of the proposal is important
- staff capability is important
- documentation of costs is essential in budget preparation
- developing a proposal does not guarantee funding
- there should be flexibility in developing the workscope
- you cannot miss the deadline for submitting a proposal

There were seven items receiving low endorsement as represented by their mean score. They are viewed as representing mythology and are as follows in shortened form:

- there is a stigma associated with not being funded
- the grant process is intentionally difficult
- small agencies' probability of obtaining continued grant support is low
- who you know is more important than the the quality of the proposal
- proposal content should be purposely left vague

- proposal development should be done by a single individual
- professional grant writers would be employed to write proposals

Based upon the results of the analysis, the authors concluded that it was possible to develop instrumentation that would function reasonably well in assessing perceptions about proposal development. There did appear to be some statements that are endorsed as reality and some endorsed as myths. In addition, there are differences in responses between those with peer panel experience and those who have not had such an experience.

It should be noted that the instrument development was carried out prior to the investigation reported in this document. Many of the realities and myths as detected in the earlier study have received support from the findings of the empirical studies cited in this report. A next step is to combine the results of the two investigations and explore further the process of proposal development in order to more firmly establish principles supporting the process.

## Commentary

The two studies reviewed here suggest that individuals involved in the process of proposal development are able to make reasonable perceptions and to hold valid attitudes towards what works and doesn't work in the process. Although working within a limited population, Siegel was able to note that potential proposal initiators have an idea of what the agencies involved would fund and not fund. As for attitudes which develop about the process, the viability of developing instrumentation which would assist in sorting out myths and realities regarding the process seems reasonable. Both studies suggest that potential fund seekers have a sense of reality about their pursuit of such funds.

## IX. A SYNTHESIS

In a recent article on the variety of mathematical models, Karplus (1983) identified three types of problems with which systems engineers and scientists deal. He does this by using the concepts of excitation, response, and system. Problems of analysis are those where the excitation and the system are given and the task is to find the response. In the case of synthesis, the excitation and response are given and the system involving the relationship is to be found or realized. In the third type of problem, the system and the response are given and the task is to find the excitation. The latter type are considered as instrumentation or control problems.

In developing a synthesis for this paper, the relationships noted above will serve as a metaphor. In the proposal case, there is an excitation in that there are conditions which stimulate or excite individuals to develop proposals, (e.g., program announcements, RFPs). There are responses in that some proposals become operating projects.

The prime interest here was the system between the excitation and the response with the aim to secure a better understanding of the "black box" of proposal development based upon empirical research. This section focuses upon drawing some salient observations about the proposal development and evaluation process by synthesizing findings from the set of studies reviewed in this paper. Statements relative to both methodology of investigation as well as substantive findings are presented with the latter being presented first.

Observations on Substance

In setting forth the synthesis of substantive observations, statements are presented which are integrative in that they may draw from one or more studies. With this condition as background, the following observations appear to have some empirical basis:

- Even though the major part of proposal development, there are very few empirical studies directed toward the task of actual proposal preparation. Proposal developers draw upon their own experience to develop the creative and conceptual elements of a proposal.
- Support services provided to proposal developers take a variety of forms but those found to be most useful focus upon assistance in developing the somewhat mechanical aspects of a proposal, such as budgets, duplication, and similar items.
- The task of proposal preparation can be a contributing factor or influence on changing organizational behavioral patterns.
- The source of proposal development support tends to be in an area immediate to the proposal developer such as the department

of assignment.

- The general distribution to interested parties of fund availability as well as information targeted to specific persons appears to be a justifiable institutional procedure.

- Training in proposal development is an activity deemed a justifiable service and cost.

- The costs of proposal development vary according to a set of variables such as the type of proposal, the agency from which funds are sought, the product to be produced, and the size of the proposal.

- Development cost estimates based upon experience tend to be positively related to actual costs derived by empirical procedures.

- The return on the investment as derived from funded proposals although somewhat low percentage-wise nevertheless justifies the costs of development.

- The decision points and responsibilities in the process of proposal development within an institution should be the object of careful study and clearly identified.

- The phase of proposal development receiving the greatest attention has been the review and evaluation process, especially the peer review system.

- Funding agencies develop both informal and formal procedures for screening applications to be reviewed.

- The quality of proposals in terms of scientific and technical merit appears to be the most important consideration in the peer review process.

- Based upon information presented in the panel sessions, raters have been found to change their ratings with the content of the information presented being more important than the expertness of the individual presenting it.

- Procedures can be developed which can increase the inter-rater reliability of peer ratings.

- The concept of "scientific merit" as a factor upon which funding decisions are made appears to be a valid one for making such decisions.
- There appear to be instances where political-social considerations tend to override the worth of proposals even as judged by peers.
- There appears to be no consistent pattern of factors or variables which distinguish between proposals that are accepted or rejected when comparisons are established.
- Information feedback to rejected applicants varies from specific, usable comments to no information of value.
- Charges of favoritism, cronyism, old boy network as influencing factors in award decisions are not supported to any strong degree.
- Applicants from high ranked or prestigious departments have an "accumulated advantage" in that the research issuing from such departments is generally of higher quality and this is reflected in the proposals submitted.
- Citation of work produced under a proposal tends to be positively related with initial and renewal ratings.
- Eminence as a scientist appears not in itself to guarantee funding.
- An individual's position in the social strata of science was found to have a positive but low relationship to ratings received on proposals.
- The peer review system while having some limitations appears to be substantiated as a viable means for establishing the scientific and technical merit of research proposals.
- Relationships between proposal quality ratings and project implementation tend to be inconsistent.

- Developing familiarity with the agency from which funds are sought is a valid behavior since there are often misperceptions by clients as to what is important to the agency.

- Individuals experienced in proposal development, including peer panel experience, tend to view the system more favorably than those who have not submitted applications or who experienced rejection.

- Instrumentation can be developed useful in assessing the realities and mythology surrounding proposal development and evaluation.

Observations on Methodology

Studies and reports included in this study were principally those in which the investigator stated a question or hypothesis and then developed a procedure or method to collect quantitative data to answer the question or hypothesis. As a consequence, many studies of what some would call qualitative or naturalistic inquiry are not included. Using the studies and reports actually cited, several observations can be made upon the methodological dimensions employed.

- Research of an experimental or variable manipulation form was not a major form of method.

- The predominant method of analysis tends to be some form of correlational analysis involving techniques such as regression analysis, discriminant analysis, one-way and multivariate analyses of variance, and path analysis.

- Survey methods were employed in the form of personal interviews, completion of self-report forms, mail surveys, telephone calls, or public hearings.

- Historical and archival methods were used to develop background material for surveys as well as providing basic data.
- In many analyses, the dependent variable was often the rating or score assigned to a proposal with other variables such as presence or absence of a proposal component, professional status, publication rates, serving as independent variables.

## X. CONCLUSIONS AND IMPLICATIONS

The prime objective of this study was to examine the existing literature relating to proposal development and evaluation in order to establish a perspective on any empirical base underlying the process. Findings relative to various aspects of the overall process were presented in previous sections of this report. Based upon those findings, a synthesis of observations regarding both the substantive nature of the studies as well as their methodological approaches was presented. Using the synthesis as a starting point, several conclusions may be drawn.

The empirical research base supporting the task of proposal development and evaluation is uneven. There are few studies supporting actions taken with regard to the process of proposal development and preparation. In contrast, there is a fairly large number of studies relating to the evaluation process, particularly with regard to the use of peer panels and the validity of their judgements. Thus one can feel more secure about statements made relative to proposal evaluation than one can with regard to proposal development.

The research reported both in the form of studies and reports focuses primarily upon those activities subject to enumeration, such as the frequency of support services utilized, preparation costs, and similar aspects. This conclusion is to some degree a condition of the literature reviewed since only studies of that type were reviewed. Nevertheless, the point to be made here is that the dimensions investigated are those that can be subjected to quantitative treatment of data. To support this conclusion, it should be noted that a comprehensive search of the literature uncovered only one or two studies that might qualify as qualitative investigations.

While there is some evidence that factors other than scientific merit sometimes enter into the evaluation of proposals, the general conclusion can be drawn that the system is trustworthy and does result in a high level of quality proposals. The proposal developer can by and large have faith that a fair review of the submitted proposal was made. The findings also imply that if an individual wanted to be a more consistent winner then affiliation with a group of colleagues of sufficient high caliber would result in significant ideas worthy of funding.

To summarize, even though a set of studies was identified relating to the task of proposal development and evaluation, one is left with the feeling that the movement from an idea to the documentation of that idea in the form of a proposal is essentially a creative act and therefore not highly amenable to empirical investigation. Until such time as creative acts can be subjected to empirical methodologies, that aspect of proposal development will have to more or less operate from a rather personal, intuitive basis rather than upon an empirical knowledge base. Thus, the current state-of-the-knowledge is rather limited in both its scope and established principles.

The principal disciplines that have initiated studies relating to the proposal development and evaluation have been those involving the natural and physical sciences. There has been much less study done in the social sciences area with even less done in the field of education. Because of the importance of individuals receiving support for continuing research programs and efforts and its effect on subsequent professional status, the research on proposals in the sciences has tended to be limited to the peer review process and award decisions.

Even though the peer review process is the continuing source of controversy (Anderson, 1983), the utilization of peers to judge the technical and/or scientific merit of proposals has validity. Charges of favoritism or similar biasing factors tend not be substantiated. The perception that the same individuals and institutions are continuous winners is based more upon the accumulated advantage accruing to the institution in the degree that it attracts quality personnel who develop high quality proposals.

Given the conclusions drawn above, what are some implications for the practice of proposal development and evaluation? It would appear that one implication is that proposal preparation will still have to rely more upon the "art" side of the task than upon the "science" side in view of the limited empirical evidence to support actions undertaken. A second implication relates to the continued provision of support service to those persons developing proposals. Since many proposal writers view these support services primarily for their mechanical contributions, perhaps efforts need to be made to see how such services can make contributions to the more creative aspects of proposal preparation. Evidence from the peer review findings suggest that if an institution would like to become a winner in the game of proposal funding, then efforts should be directed toward building prestigious departments wherein innovative ideas can be developed between and among individuals. Such an action would aid in building a foundation for a "track record" of quality proposal development. Regardless of the path chosen, the findings of this investigation support the investment of resources to acquire new funds since the return on such investment, while sometimes low, is nevertheless in a positive direction.

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## APPENDIX A

### Profile of Search Terms

Grant Application
Grant Development
Grant Review
Peer Panel
Peer Review
Proposal Development
Proposal Writing
Proposal Evaluation
Proposal Preparation
Proposal Review
Grantsmanship